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10/673,138	09/30/2003	Andrej S. Mitrovic	236518US6YA	3830
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OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			SAXENA, AKASH	
			ART UNIT	PAPER NUMBER
			2128	
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			08/27/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/673,138

Applicant(s)

MITROVIC, ANDREJ S.

Examiner

Akash Saxena

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 July 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-47 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-47 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claim(s) 1-47 has/have been presented for examination based on amendment filed on 20th July 2007.
2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 20th July 2007 has been entered.
3. Claim(s) 44 is/are amended.
4. Applicant appears to indicate that claims 1-47 are rejected under 35 USC § 102(e) as being anticipated by Sonderman et al (US Pat. No. 6802045). There is no such rejection in the current office action.
5. Claim(s) 1-47 remain rejected under 35 USC § 103.
6. The arguments submitted by the applicant have been fully considered. Claims 1-47 remain rejected and this action is made NON-FINAL. The examiner's response is as follows.

Response to Applicant's Remarks & Examiner's Withdrawals

7. Examiner withdraws the claim rejection(s) under 35 USC § 101 to claim(s) 44 in view of the amendment and/or applicant's arguments.

Response to Applicant's Remarks for 35 U.S.C. § 103

8. Claims 1-47 were rejected under 35 U.S.C. 103(a) as being unpatentable over **Sonderman**, in view of **Jain**.

(Argument 1) Applicant has cited Sonderman Col.9 Lines 46-51

The system 100 then optimizes the simulation (described above) ***to find more optimal process target*** (T.sub.i) ***for each silicon wafer, S.sub.i. to be processed***. These target values are then used ***to generate new control inputs***, X.sub.Ti, on the line 805 to control ***a subsequent process of a silicon wafer S.sub.i*** [Emphasis added by examiner]. The ***new control inputs***, X.sub.Ti, are generally based upon a plurality of factors, such as simulation data, output requirements, product performance requirements, process recipe settings based on a plurality of processing tool 120 operating scenarios, and the like.

with the following argument:

Thus, this section of Sonderman et al clearly discloses that the simulation is to find a more optimum process target for each silicon wafer to be processed. **The simulation results produce a new control input for the silicon wafer to be processed.** Thus, Applicant respectfully submits that Sonderman et al. teach performing first principles simulation for the actual process to be performed before performance of the actual process, and not the claimed performing first principles simulation ***for the actual process being performed during performance of the actual process.***

(Response 1) Applicant emphasized section of Sonderman is bolded and italicized.

Examiner cited portion is bolded and underlined.

Examiner disagrees with the applicant that argument because the results of the simulation are applied to the same semiconductor. Sonderman clearly states each silicon wafer S.sub.i is exposed to new control inputs for subsequent processing (not subsequent wafer in the next round as indicated by second underlined phrase). If the intent of Sonderman not was to indicate that new control inputs generated by simulation for the actual process being performed during performance of the actual process, he would have stated it is applied to the subsequent **silicon wafer S.sub.i+1.**

Instead the inputs are applied to the same silicon wafer **S.sub.i.** Applicant's arguments are unpersuasive.

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(Argument 2) Applicant has cited Fig.4 from Sonderman requiring the steps in Fig.4 and presenting the following argument.

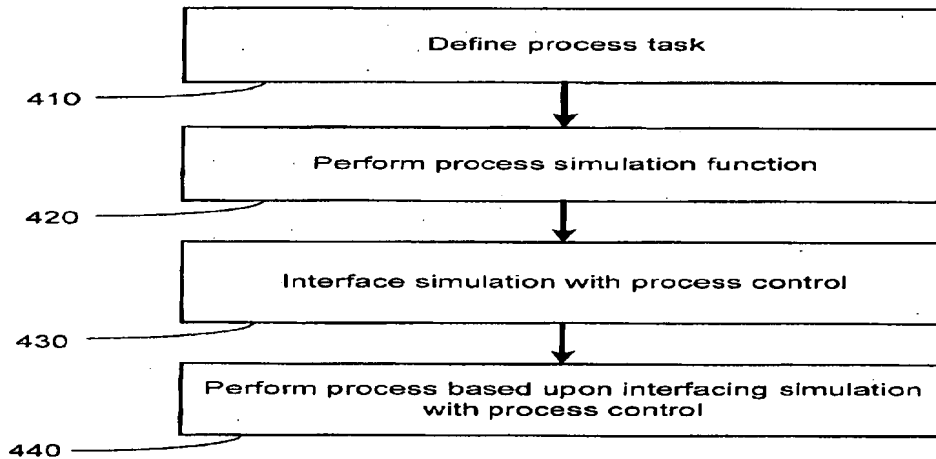


FIGURE 4

Hence, the process flow in Sonderman et al is straightforward:

- 1) define process to be modeled,
- 2) model process for simulation result,
- 3) interface simulation result to processor, and then
- 4) run the process under control based on the pre-existing simulation result.

Note also that this sequence in Sonderman et al means that Sonderman et al do not disclose inputting process data relating to an actual process being performed by the semiconductor processing tool, as also claimed. Rather, Sonderman et al use data from previous runs to produce a simulation result.

Accordingly, Applicant respectfully submits that Sonderman et al do not disclose and indeed teach away from the present invention.

(Response 2) Examiner thanks applicant for their interpretation, however the interpretation is incomplete with the reference that this process involves a feedback, therefore the applicant's assertion that control is based on the pre-existing simulation result and Sonderman et al does not disclose inputting process data relating to an actual process being performed by the semiconductor processing tool is incorrect. Sonderman Col.4 Line 65-Col.5 Line 10 states:

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Furthermore, the simulation environment 210 can be used for feedback modification of control parameters invoked by the process control environment 180. For example, the manufacturing environment 170 can send metrology data results into the simulation environment 210. The simulation environment 210 can then use the metrology data results and perform various tests and calculations to provide more accurate, modified control parameters to the process control environment 180. A feedback loop is then completed when the process control environment 180 sends the modified or adjusted process control parameters to the manufacturing environment 170 for further processing of semiconductor wafers.

Sonderman clearly teaches inputting process data relating to an actual process being performed by the semiconductor processing tool, into the simulator and applying the simulation result to the semiconductor-processing tool.

Further in support of examiner's argument, applicant is also performing the same process of feedback modification (See specification Fig.7). In conclusion, Sonderman does not teach away from the claimed invention and applicant's arguments are found to be unpersuasive.

(Argument 3) Applicant has argued that Jain does not overcome the deficiencies of Sonderman.

(Response 3) Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Applicant has merely cited portion of Jain without clearly showing why Jain does not overcome the deficiencies of Sonderman.

(Argument 4) Applicant has stated the following:

Moreover, the proposed development work in Jain is understood better in the light of the "conventional approach" referred to by Kee et al, made of record by the Information Disclosure Statement filed December 20, 2005.

Further arguments are presented with current case law KSR International Vs.

Teleflex Inc.

(Response 4) First, Kee et al is not used as prior art for rejecting the current invention. Secondly, examiner fails to see the connection between Jain and Kee et al as neither of them reference to each other in any way. Thirdly, Applicant also has not further established why the so-called “conventional approach” would link them. In light of the above applicant’s arguments are found to be unpersuasive.

(Argument 5) Applicant has argued:

In the present situation, the claimed method of performing a first principles simulation for the actual process being performed during performance of the actual process produces more than an expected result in that Sonderman et al (*in having to develop a new control inputs for each subsequent wafer*) can not compensate for real time excursions from the existing model occurring while the wafer is being processed. In other words, the lengthy time for generation of a first principles model simulation in the prior art prevents one from realizing a real time process control based on a first principles simulation during the actual process. Indeed, as pointed out above, the examiner considered it an impossibility to simultaneously perform a first principles simulation result and to control the actual process being run with the first principles simulation result. Hence, the claimed processes and systems produce an unexpected result.

(Response 5) Examiner thanks applicant for the remarks above, however the new control inputs are not developed for the processing of each subsequent wafer, but instead are for subsequent processing [performed on] a silicon wafer S.sub.i (Sonderman: Col.9 Lines 44-46 – this point is also addressed above in response to argument 1).

Further **most importantly** applicant is arguing limitation, which are not present in the claim and may constitute patentable subject matter. Specifically, as indicated by applicant “the lengthy time for generation of a first principles model simulation in the prior art prevents one from realizing a real time process control based on a first principles simulation during the actual process.” However, this is the conclusory statement, where what makes the current first principle simulation model realize the real time process control possible

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is not claimed. Further distinguishing it from Sonderman may also help in defining a more patentable subject matter.

Claim Rejections - 35 USC § 112¶1st and response the applicant's remarks

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claim 1-47 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. Exact details of what basic physical and chemical attribute of the semiconductor processing tool are used to construct a first principle simulation model which is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976).

Applicant has argued citing specification paragraphs [0035] and [0036] as to what constitutes first principle physical model.

(Response to applicant's remarks)

Applicant has provided an exact support in disclosure for such attributes in the model. Applicant has incorrectly quoted specification paragraphs [0035] and [0036]. These paragraph are not enabling although they rely on the commercially available packages to model the various first principle simulation models, the details of the model are absent from the specification. The details of these model ~~lead to~~ which lead to unexpected results (Argument & response 5) are very relevant to the

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designing the first principle physical model. Examiner respectfully maintains the rejection.

Response to Applicant's Remarks for Double Patenting

10. Applicant's arguments relating to filing a terminal disclaimer for applications 10/673,501 and 10/673,583 are considered and double patenting rejection is maintained until a terminal disclaimer is filed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 1-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,802,045 issued to Sonderman et al (Sonderman hereafter), in view of IEEE article "Mathematic-physical engine: parallel processing for modeling and simulation of physical phenomena" by Jain et al (Jain hereafter).

Regarding Claim 1

Sonderman teaches a method to facilitate a process performed by a semiconductor-processing tool (Sonderman: Summary, at least in Col.2 Lines 10-17; Col.3 Lines 45-49) by inputting process data relating to the process performed by the semiconductor-processing tool (Sonderman: at least in Col.3 Lines 50-67; Col.7 Lines 8-20). Further, Sonderman teaches inputting the first principle physical model relating to the semiconductor-processing tool describing at least one of a basic physical or chemical attributes (Sonderman: at least in Col.5 Lines 11-17; 49-67) as device physics model, a process model and an equipment model. Further, Sonderman teaches performing first principle simulation *for the actual process being performed during performance of actual process* (Sonderman: Col.7 Lines 4-7; Col.3 Lines 56-63, Fig. 1-3) using the physical model to provide simulation results in accordance with the process data relating to the actual process being performed in order to simulate the actual process being performed (Sonderman: at least in Col.5-7; at least Col.7 Lines 8-20). Further, Sonderman teaches using the simulation results obtained during the performance of the actual process (Sonderman: Fig. 1-3

Col.7 Lines 4-7; Col.3 Lines 56-63) to facilitate the actual process performed by the semiconductor-processing tool (Sonderman: at least in Col.4 Lines 48-64; Fig.1-8).

Sonderman does not teach first principle model including a set of computer encoded differential equations.

Jain teaches computer encoded differential equations using MPE engine, which can be applied to wafer processing (Jain: Abstract). Jain also teaches dedicated and wafer level implementation of MPE engine to provide enhanced performance (Jain: Pg. 372 Section V Dedicated MPE).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to apply the teachings of Jain to Sonderman to solve differential equation for the semiconductor processing tool. Sonderman teaches building various models, which work in real-time feedback control simulating actual semiconductor modeling process (Sonderman: Fig.1; Col.7 Lines 8-20), while Jain makes possible by providing model-solving capacity in real time when differential equations are present in the model (like thermal patterns in semiconductor wafer model) (Jain: Abstract).

Regarding Claim 2

Sonderman teaches directly inputting the process data relating to the actual process performed by the semiconductor-processing tool from at least one of physical sensor (eg. Scatterometry data, overlay data, dimensional data) and a metrology tool physically mounted on the semiconductor-processing tool (Sonderman: at least in Col.4 Lines 31-48; Col.4-8; Fig.1, 7; Col.7 Lines 8-20).

Regarding Claims 3-5

Sonderman teaches indirectly inputting the process data relating to the actual process performed by the semiconductor-processing tool from one of the manual input devices and a database as manual fashion data retrieval and automatic data retrieval; inputting data recorded from the previous run; inputting the data set by a simulation operator ((Sonderman: at least in Fig.1-3 Col.1; Col.4-7; Col.7 Lines 8-20).

Regarding Claims 6-9

Sonderman teaches inputting process data relating to at least one of the physical characteristics of the semiconductor-processing tool and semiconductor tool environment, data relating to at least one of the characteristics and a result of a process performed by the semiconductor processing tool; inputting a spatially resolved model (as modified models) of the geometry of the semiconductor processing tool; inputting fundamental equations necessary to perform first principle simulation for the desired simulation result (Sonderman: at least in Col.5 Lines 10-18; Col.6 Lines 48-63; Col.9 (equations); Col.5-9; Fig 1-3; Col.7 Lines 8-20).

Regarding Claim 10

Sonderman teaches performing interaction concurrently between the simulation environment (first principle simulation) and the semiconductor-processing tool (Sonderman: Fig.2; Col.4 Lines 48-63).

Regarding Claims 11-13

Sonderman teaches performing first principle simulation not concurrently with the process performed; inputting data from at least one initial condition recorded from a previous process performed (Sonderman: at least in Col.5-8; Fig.3-4).

Regarding Claims 14-18

Sonderman teaches using a network of interconnected resources inside the semiconductor manufacturing facility (Sonderman: Semiconductor tools on the factory floor – Col.9 Lines 60-65) to perform first principle simulation (Jain: Section III) recited in claim 1; using code parallelization among interconnected computational resources to share the computational load of the first principle simulation; sharing simulation information among the interconnected resources to facilitate a process by the semiconductor-processing tool; sharing simulation results among the interconnected resources to reduce redundant execution of substantially similar first principle simulation by different resources; sharing information comprising model changes among the interconnected resources to reduce the redundant refinements of first simulation by different resources (Sonderman: Fig.1-3, computer code software is described in Col.9 Lines 58 onward; Col.5-8).

Regarding Claims 19-20

Sonderman teaches remote access to computational and storage resources (Sonderman: Col.9 Line 58-Col.10 Line 31) where in wide area network is art inherent.

Regarding Claim 21

System claim 21 discloses substantially similar limitations as method claim 1 and is rejected for the same reasons as claim 1.

Regarding Claim 22

System claim 22 discloses substantially similar limitations as method claim 2 and is rejected for the same reasons as claim 2.

Regarding Claims 23-25

System claims 23-25 disclose substantially similar limitations as method claims 3-5 and are rejected for the same reasons as claims 3-5.

Regarding Claims 26-29

System claims 26-29 disclose substantially similar limitations as method claims 6-9 and are rejected for the same reasons as claims 6-9.

Regarding Claim 30

System claim 30 discloses substantially similar limitations as method claim 10 and is rejected for the same reasons as claim 10.

Regarding Claims 31-33

System claims 31-33 disclose substantially similar limitations as method claims 11-13 and are rejected for the same reasons as claims 11-13.

Regarding Claims 34-38

System claims 34-38 disclose substantially similar limitations as method claims 14-18 and are rejected for the same reasons as claims 14-18.

Regarding Claims 39-40

System claims 39-40 disclose substantially similar limitations as method claims 19-20 and are rejected for the same reasons as claims 19-20. Change in dependency from claim 34 to 21 of claim 39 is noted.

Regarding Claim 41

System claim 41 discloses substantially similar limitations as method claim 1 and is rejected for the same reasons as claim 1.

Regarding Claim 42

System claim 42 discloses substantially similar limitations as method claim 15 and is rejected for the same reasons as claim 15. Sonderman teaches means for sharing *inside the semiconductor manufacturing facility (Sonderman: Semiconductor tools on the factory floor – Col.9 Lines 60-65)* the computation load as shown in claim 15 rejection.

Regarding Claim 43

System claim 43 discloses substantially similar limitations as method claim 16 and is rejected for the same reasons as claim 16.

Regarding Claim 44

System claim 44 discloses substantially similar limitations as method claim 1 and is rejected for the same reasons as claim 1.

Regarding Claims 45-47

Jain teaches use of Navier Stokes and other known simulation solutions for solving various simulation problems as initial condition (Jain: Pg. 367-368 Section "Governing Rationale" Sub-Section A. Governing Equations). Sonderman also teaches initializing the models with input data (Sonderman: Col.7 Lines 8-20).

Conclusion

1. All claims are rejected.
2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
3. **Examiner's Note:** Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant.

Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.


Communication

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Akash Saxena whose telephone number is (571) 272-8351. The examiner can normally be reached on 9:30 - 6:00 PM M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini S. Shah can be reached on (571)272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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